LITE MINE ROOF SUPPORT CRIB AND METHOD

FIELD OF THE INVENTION

The present invention is related to mine support cribs. More specifically, the present invention is related to mine support cribs having reduced amounts of wood or material.

BACKGROUND OF THE INVENTION

Over the last several years, increased attention has been given to more efficient systems of standing support for underground mines. U.S. Patent No. 5,746,547 teaches a support formed by a plurality of parallel, notched chocks which are assembled to create a singular structure. While unique, this structure has the drawback of being material intensive. In many cases, the device provides more support than is necessary for the task and as such is not cost effective.

This is also true when available or desirable wood is in limited supply, or the wood has a generally small cross section. In these circumstances, the wood available needs to be used in a way that would still allow cribs to be formed that withstand the desired vertical loads placed on them.

SUMMARY OF THE INVENTION

The present invention pertains to a mine roof support crib. The crib comprises a plurality of chocks that are connected together through notches in the chocks to form at least three planes and able to support at least five tons of load. Each notch has only one edge.

The present invention pertains to a mine roof support crib. The crib comprises a plurality of chocks that are connected together through notches in the chocks to form at least three planes and are able to support at least five tons of load. Each chock has a primary piece having a top and a bottom, a first block and a second block disposed on the top and bottom, respectively, and means for attaching the first block and second block to the primary piece.

The present invention pertains to a method of forming a mine roof support crib. The method comprises the steps of placing a first chock having at least one notch with only one edge in a mine. There is the step of placing a second chock having at least one notch with only one edge in the mine and adjacent to the first chock. There is the step of linking a third chock having at least one notch with only one edge with the one notch of the first chock and the one notch of the second chock. There is the step of linking a fourth chock having at least one notch with only one edge with a second notch of the first chock and a second notch of the second chock. There is the step of linking a desired number of additional chocks having notches with only one edge onto each other or the first, second, third or fourth chocks through notches of and the respective chocks until at least two planes are formed.

The present invention pertains to a method of forming a chock for a mine roof crib to support a mine roof. The method comprises the steps of attaching a first block to a top surface of a primary piece in spaced relationship to each end of the primary piece to define notches at each end of the top surface of the primary piece. There is the step of attaching a second block to a bottom surface of the primary piece in spaced relationship to each end of the primary piece to define notches at each end of the bottom surface of the primary piece.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, the preferred embodiment of the invention and preferred methods of practicing the invention are illustrated in which:

Figure 1 shows a chock of a first embodiment of the present invention.

Figure 2 shows a chock of a second embodiment of the present invention.

Figures 3 and 4 show a chock of a third embodiment of the present invention.

Figures 5 and 6 show a chock of a fourth embodiment of the present invention.

Figures 7, 8, 9 and 10 show a chock of a fifth embodiment of the present invention with a spacer, bar pin or staple, respectively.

Figure 11 shows a crib of the present invention.

Figure 12 is a graph of support performance.

DETAILED DESCRIPTION

Referring now to the drawings wherein like reference numerals refer to similar or identical parts throughout the several views, and more specifically to figure 11 thereof, there is shown a mine roof support crib 10. The crib 10 comprises a plurality of chocks 12 that are connected together through notches 14 in the

chocks 12 to form at least three planes 16 and able to support at least five tons of load. Each notch has only one edge 18.

Preferably, the plurality of chocks 12 connected together can support at least 20 tons of load. Each chock 12 preferably has a long axis 20 and each notch of the chock 12 is cut at a right angle to the long axis 20 of the chock 12. Preferably, the plurality of chocks 12 forms four planes 16.

At least two of the planes 16 are preferably in perpendicular relation with each other. Each notch can have either a spacer 22 or a bar pin 24 or a staple 26 defining a receive zone 28 with the edge 18 of the corresponding notch, as shown in figures 7-10. The receive zone 28 receives a notch of an adjacent chock 12. The height of the spacer 22, bar pin 24 or staple 26 is preferably less than the rise of the edge 18 of the corresponding notch.

Each chock 12 preferably has a primary piece 30 having a top and a bottom, a first block 36 and a second block 38 disposed on the top and bottom, respectively, and means for attaching the first block 36 and second block 38 to the primary piece 30. An outward surface of the first block 36 and second block 38 defines the edge 18 of a first notch and of a second notch of each chock 12. The crib 10 preferably includes a base 48 on which the chocks 12 are disposed. The base 48 is adapted to reside on a floor 50 of the mine. Preferably, the crib 10 includes a top portion 52 which is disposed on the chocks 12 which is adapted to fit between the chocks 12 and a roof 54 of the mine so the chocks 12 are prestressed.

The present invention pertains to a mine roof support crib 10, as shown in figures 1 and 11. The crib 10 comprises a

plurality of chocks 12 that are connected together through notches 14 in the chocks 12 to form at least three planes 16 and are able to support at least five tons of load. Each chock 12 has a primary piece 30 having a top surface 32 and a bottom surface 34, a first block 36 and a second block 38 disposed on the top and bottom, respectively, and means for attaching the first block 36 and second block 38 to the primary piece 30.

Preferably, the attaching means includes a nail 56 or wire 58. Each chock 12 can include a third block 40 and a fourth block 42 in spaced relationship with the first and second blocks 36, 38, respectively, as shown in figure 2. The third and fourth blocks 40, 42 are attached to the primary piece 30. Preferably, the primary piece 30 has a first end and a second end and a top surface 32 and a bottom surface 34 and the first block 36, second block 38, third block 40 and fourth block 42 are in spaced relationship from the first end of the top surface 32, first end of the bottom surface 34, second end of the top surface 32 and second end of the bottom surface 34, respectively, to form notches 14 in the chock 12.

The first block 36 and second block 38 are preferably made of oak, hard gum, wattle, maple, hickory, poplar or pine or concrete or a composite of wood fiber cement. Preferably, the primary piece 30 has a first end and a second end and a top surface 32 and a bottom surface 34 and the first block 36 and second block 38 are in spaced relationship with the first end and second end of the top surface 32, and the first end and second end of the bottom surface 34, respectively, to form notches 14 in the chock 12 with each notch having an edge 18 defined by the respective block, to receive a notch from an adjacent chock 12.

Alternatively, each notch has either a spacer 22 or a bar pin 24 or a staple 26 defining a receive zone 28 with the edge 18 of the corresponding notch, the receive zone 28 receiving a notch of an adjacent chock 12, as shown in figures 7-10. The height of the spacer 22, bar pin 24 or staple 26 can be less than the rise of the edge 18 of the corresponding notch.

The crib 10 can include a fifth block 44 and a sixth block 46 in spaced relationship with the first and second blocks 36, 38, respectively, as shown in figures 3 and 4. The third and fifth, and fourth and sixth blocks 42, 46 each form a notch with the first block 36 and second block 38, respectively, to receive a notch from a respective chock 12. The height of the third, fourth, fifth and sixth blocks 44, 46 can be less than the heights of the first block 36 and second block 38.

The present invention pertains to a method of forming a mine roof support crib 10. The method comprises the steps of placing a first chock 12 having at least one notch with only one edge 18 in a mine. There is the step of placing a second chock 12 having at least one notch with only one edge 18 in the mine and adjacent to the first chock 12. There is the step of linking a third chock 12 having at least one notch with only one edge 18 with the one notch of the first chock 12 and the one notch of the second chock 12. There is the step of linking a fourth chock 12 having at least one notch with only one edge 18 with a second notch of the first chock 12 and a second notch of the second chock 12. There is the step of linking a desired number of additional chocks 12 having notches 14 with only one edge 18 onto each other or the first, second, third or fourth chocks 12 through notches 14 of and the respective chocks 12 until at least two planes 16 are formed.

Preferably, after the linking a desired number of additional chocks 12, there is the step of supporting a load of at least five tons with the additional chocks 12 and the first, second, third and fourth chocks 12.

The present invention pertains to a method of forming a chock 12 for a mine roof crib 10 to support a mine roof 54. The method comprises the steps of attaching a first block 36 to a top surface 32 of a primary piece 30 in spaced relationship to each end of the primary piece 30 to define notches 14 at each end of the top surface 32 of the primary piece 30. There is the step of attaching a second block 38 to a bottom surface 34 of the primary piece 30 in spaced relationship to each end of the primary piece 30 to define notches 14 at each end of the bottom surface 34 of the primary piece 30.

Preferably, there is the step of placing a stop adjacent each end of the primary piece 30 and in spaced relationship with the respective block to define a receiving zone 28 to receive a notch of another chock 12. The stop preferably includes blocks, spacers, 22 bar pins 24 or staples 26.

In the operation of the invention and referring to figure 11, there is shown a crib 10 that is formed from chocks 12 as shown in figure 1. The chock 12, shown in figure 1, is formed of a primary piece 30 made of wood and a first block 36 on top of the primary piece 30 and a second block 38 on the bottom of the primary piece 30. The first block 36 and the second block 38 are attached to the primary piece 30 by nails 56 or by spinning wire 58 through the wood, as is well known in the art. The end of each surface of the first block 36 and the second block 38 is in spaced relationship with the respective end of the primary piece 30, defining a notch with an edge 18.

In another embodiment, as shown in figure 2, there is a primary piece 30 and a first block 36, second block 38, third block 40 and fourth block 42 attached to the primary piece 30. Each block is in spaced relation with the other block on the same surface of the chock 12, and in spaced relation with the respective end of the primary piece 30. The edge 18 of each block adjacent to the respective end of the primary piece 30 defines a notch. The edge 18 of each block defines an edge 18 of a notch in which a notch of another chock 12 is dispensed.

In another embodiment, as shown in figure 3 and figure 4, there is shown a chock 12 having a block attached at the four corners, with each of these blocks in spaced relationship with the middle blocks on their respective surface of the primary piece 30. This embodiment of a chock 12 would serve three purposes. 1, to increase the contact area and hence increase the load capacity of the crib 10. 2, to help ensure the chocks 12 on the layer above and the layer below are positioned in the correct place between the end blocks and the respective middle blocks. 3, to ensure the interlock and prevent the chocks 12 from moving outwards under load.

Figures 5 and 6 show yet another embodiment of a chock 12 that is similar to the embodiment shown in figures 3 and 4. The only difference is that the blocks on each corner have a height which is less than the rise of the attached center blocks. This embodiment of a chock 12 would serve purposes 2 and 3, as described above, for the chock 12 of figures 3 and 4.

Figures 7, 8, 9 and 10 show yet another embodiment of a chock 12 for use in the mine roof crib 10. In the chock 12 shown in figure 7, there is again a first piece and a second piece attached to the primary piece 30. Adjacent to the ends of the

primary piece 30 are placed either spacers 22, bar pins 24 or staples 26 where their height is less than the rise of the first and second pieces. The placement of the spacers 22, bar pins 24 or staples 26 is well known in the art. The purposes of such a chock 12, is the same as the purposes identified for the chock 12 in figures 5 and 6.

The attachment of the blocks to the primary piece 30 can be accomplished with the use of nails 56 or by spinning wire 58 through wood. The blocks can be of various types of wood, such as those mentioned above. The blocks to be made of concrete that are cast with holes through them to allow wires 58 to pass to them and be inserted into the wood of the primary piece 30 as is well known in the art. The blocks can also be made out of a wood cement composite, as is well known in the art.

The chocks 12 of the various embodiments are stacked on top of each other to a desired height on a base 48 which could be formed simply of two primary pieces 30 in spaced relationship with each other and in parallel with each other a distance apart that would conform with notches 14 of a chock 12 that would be fitted on them, as shown in figure 7. Once the chocks 12 stacked on top of each other reach a desired height, then planks or grout bags or other commonly used tops are inserted on the chocks 12 to prestress the crib 10 with the mine roof 54.

All of these cribs 10 can support at least 5 tons of compression load without failure, and in fact even greater loads, as shown in figure 12. Figure 12 is based on chocks 110 cm long by 15 cm high (primary piece and first and second blocks) by 7.5 cm wide forming a crib 1.3 m high.

The crib 10 is made functional as a support by filling in any space between the top portion 52 of the support and the surface of the rock mass to be supported by one or more of the following methods.

Timber or metal blocking and wedges 85 installed either parallel to or perpendicular to the long axis 20 of the chocks 12. This material would be installed preferably at the opposing ends of each chock 12 and at the points of engagement of the notches 14, as shown in figure 11.

Using grout bladders 87 into which a polymeric or cementitious grout can be pumped to fill in the space between the support and the rock surface, as shown in figure 11. These grout bladders may be made to match the shape of the support or may be substantially larger and made to cover multiple supports installed in a given area.

Both of the above techniques if installed with sufficient force may enable the support to provide an active restraint and reinforcement effect to the rock mass. See U.S. patent application 09/415,387, allowed but not yet issued, incorporated by reference herein.

Preferably, to more efficiently utilize the wood available, by minimizing its use, but attaining a desired load capability, the height of a chock is about two times its width. In contrast, a more timber intensive chock would have its height equal to its width.

Furthermore, by forming a chock out of pieces, the pieces can be of different materials, some stronger, some weaker, to

essentially allow mixing and matching of the pieces, to spread the strong pieces out with weaker pieces to form many chocks, when there is not an unlimited supply of stronger pieces. For instance, the primary piece can be a less strong wood while the first and second blocks can be of a stronger or denser wood, or vice versa. This is one of the advantages of attaching blocks, such as concrete or wood fiber cement (which are not even made of wood), which is stronger or denser then the other types of wood that can be used for the primary piece. This also allows for the chocks to have their cross section built up from wood that has a smaller than desired cross section. By attaching the blocks to the primary piece, each of which by themselves has a cross-section too small, together they have a cross section which is larger, for better supporting a mine roof.

Although the invention has been described in detail in the foregoing embodiments for the purpose of illustration, it is to be understood that such detail is solely for that purpose and that variations can be made therein by those skilled in the art without departing from the spirit and scope of the invention except as it may be described by the following claims.